

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

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U.S. PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS
AND INTERFERENCES

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SARATHY RAJAGOPALAN and MINH VUONG

Appeal No. 2005-0466
Application No. 09/465,131

ON BRIEF

Before DIXON, BLANKENSHIP, and NAPPI, Administrative Patent Judges.

BLANKENSHIP, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's rejection of claims 1-6, which are all the claims in the application.

We reverse.

BACKGROUND

The invention relates to thermal profiling devices used in flip-chip semiconductor device fabrication. Claims 1 and 6 are independent. Representative claim 1 is reproduced below.

1. A thermal profiling device for a flip-chip-integrated circuit comprising:
 - a packaging substrate of a flip-chip integrated circuit;
 - a semiconductor die of the flip-chip integrated circuit having an active circuit surface for interconnecting the semiconductor die to the packaging substrate wherein the active circuit surface is secured directly to an upper surface of the packaging substrate; and
 - a thermocouple secured directly to the active circuit surface of the semiconductor die for measuring a temperature of the active circuit surface of the semiconductor die during a reflow process.

The examiner relies on the following references:

Lemoine et al. (Lemoine)	5,585,577	Dec. 17, 1996
Wyland	5,997,174	Dec. 7, 1999 (filed Jul. 21, 1997)
Thorson et al. (Thorson)	6,131,579	Oct. 17, 2000 (filed Apr. 21, 1998)

Claims 1, 4, and 5 stand rejected under 35 U.S.C. § 103 as being unpatentable over the specification's admitted prior art (APA) and Wyland.

Claim 6 stands rejected under 35 U.S.C. § 103 as being unpatentable over APA, Wyland, and Lemoine.

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Claims 2 and 3 stand rejected under 35 U.S.C. § 103 as being unpatentable over APA, Wyland, and Thorson.

We refer to the Examiner's Answer (mailed Sep. 23, 2004) for a statement of the examiner's position and to the Brief (filed Jun. 16, 2004) for appellants' position with respect to the claims which stand rejected.

OPINION

We cannot sustain the rejection of instant claim 1 under 35 U.S.C. § 103 as being unpatentable over APA and Wyland, substantially for the reasons expressed by appellants in the Brief.

The rejection (Answer at 4-5) relies on Wyland as teaching a thermal system for a semiconductor die comprising a thermocouple 117 secured on the junction between surfaces 113, 114 "for measuring and controlling a junction/interface temperature." The examiner reiterates, at page 8 of the Answer, that it is clear from Wyland that "in order to measure the temperature at an interface of two structures, a thermocouple is provided and secured directly to the desired surface that is intended to be monitored." Wyland is thus deemed to teach that "in order to monitored [sic] a junction / interface temperature between surfaces," a thermocouple is directly secured to the desired surface under study.

Wyland is directed to a board simulator used to simulate an actual board ("target board") on which an electronic component is to be operated, so as to estimate the

energy transferred by the electronic component and the junction temperature of the semiconductor die inside the electronic component. Col. 1, ll. 44-49.

Wyland shows, in Figure 1A, a board simulator 110 that is attached to test component 120. Board simulator 110 includes a thermoelectric cooler 111, a heatsink 112, and a coupon 113. Coupon 113 is formed of the same material as the target board or, in the alternative, may be formed of a non-thermally conductive material so that heat flowing to coupon 113 can be determined from the temperatures at the coupon's two sides, a first side 113a and a second side 113b. Col. 4, ll. 58-67. Second side 113b of coupon 113 is thermally coupled to a first side 111a of thermoelectric cooler 111 by a first thermally conductive substrate 114. Col. 5, ll. 11-24. Insulation 116 ensures that substantially all the heat received by coupon 113 from test component 120 flows through thermoelectric cooler 111 to heatsink 112. Id. at ll. 25-28.

A first thermocouple 117 is mounted on a surface 113b of coupon 113, and thermally coupled by thermally conductive substrate 114 to a first side 111a of thermoelectric cooler 111. A second thermocouple 118 is suspended in the ambient air surrounding heatsink 112. "Thermocouples 117 and 118 are respectively used to monitor voltages V_d and V_w , that correspond respectively to device temperature T_d and coolant temperature T_w . The difference $T_d - T_w$ is indicative of the thermal resistance of board simulator 110." Id. at ll. 39-48.

Thermocouple 117 is thus not placed at the interface of surfaces 113 and 114 to measure a "junction" or interface temperature between the surfaces. Rather, the

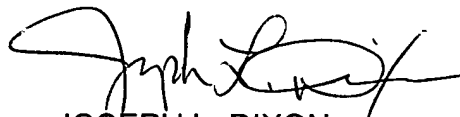
purpose of thermocouple 117 is to measure device temperature T_d , for calculating thermal resistance of board simulator 110. Note also model 400 (Fig. 4), indicating junction temperature T_j , device temperature T_d offset from junction J, and " R_p " representing board thermal resistance. Col. 8, ll. 6-45. Integrated circuit die 122 includes a heating element 123 (Fig. 2) and a temperature sensor 124, for measuring junction temperature adjacent to the heating element. Col. 7, ll. 3-21; col. 3, ll. 3-6. The board simulator acts as a thermal equivalent of the target board, allowing the junction temperature of an electronic component mounted on the target board to be determined empirically, from the junction temperature of the test component. Col. 2, ll. 28-34.

We are thus in substantial agreement with appellants, in that the examiner's findings with respect to what Wyland teaches are in error. The rejection thus does not show that APA and Wyland would have suggested a thermocouple secured directly to the active circuit surface of the semiconductor die, as required by instant claim 1. Since claim 6 contains a similar limitation, and neither Lemoine nor Thorson remedy the deficiency of the rejections applied against the independent claims, we cannot sustain any of the § 103 rejections on appeal.

CONCLUSION

The rejection of claims 1-6 under 35 U.S.C. § 103 is reversed.

REVERSED



JOSEPH L. DIXON
Administrative Patent Judge



HOWARD B. BLANKENSHIP
Administrative Patent Judge



ROBERT E. NAPPI
Administrative Patent Judge

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